

National Health and Nutrition Examination Survey

National Youth Fitness Survey (NNYFS), 2012

This is an interim report to be used with the NNYFS data release. A published report is forthcoming.

November, 2013

Centers for Disease Control and Prevention
National Center for Health Statistics
Division of Health and Nutrition Examination Surveys

Table of Contents

1.	Introduction	4
2.	Planning and Sample Design.....	4
2.1.	Children’s Physical Activity Feasibility Study	5
2.2.	Sample Design	6
3.	Ethical, Privacy, and Confidentiality Considerations	7
3.1.	Ethics Review Board	7
3.2.	Informed Consent	7
4.	Field Operations	8
4.1.	Advance Arrangements	8
4.2.	Staffing	8
4.3.	Household Interview.....	9
4.3.1	Screener.....	9
4.3.2	Sample Person and Family Questionnaires	9
5.	Mobile Center (MC) Operations	11
5.1.	Staffing	11
5.2.	Safety Precautions	11
5.3.	Examinations	12
5.3.1.	Body Measures	13
5.3.2.	Core Muscle Strength (Plank)	13
5.3.3.	Gross Motor Skills	13
5.3.4.	Lower Body Muscle Strength	13
5.3.5.	Upper Body Muscle Strength—Grip Strength	14
5.3.6.	Upper Body Muscle Strength—Modified Pull-up	14
5.3.7.	Physical Activity Monitor—Accelerometer.....	14
5.3.8.	Aerobic Fitness—Maximal and Submaximal Exercise Test.....	15
5.4.	MC Interviews	15
5.4.1.	Physical Activity Questionnaire.....	15
5.4.2.	Dietary Recall.....	16
5.4.3.	Computer-Assisted Self-Interview (CASI)	16
6.	Report of Findings and Remuneration	16
7.	Data Release and Analytic Guidelines	17

7.1. Key Demographic Variables of Interest	17
7.1.1. Defining Age Group Categories.....	18
7.1.2. Race and Hispanic Origin	18
7.2. Family Relationship.....	19
7.3. Geographic and Seasonal Considerations.....	19
7.4. Effect of Nonresponse	20
7.4.1. Unit or Sample Child Nonresponse.....	20
7.4.2. Component or Item Nonresponse.....	21
7.4.3. Other Key Concepts About Missing Data.....	22
7.5. Survey Sample Weights.....	22
7.5.1. Determining the Appropriate Sample Weight for Analysis	23
7.6. Variance Estimation	23
7.6.1. Variance Estimation Methods	24
7.6.2. Other Sources of Variability	24
7.7. Statistical Reliability of Estimates.....	24
7.8. Estimation of Population Counts.....	25
7.9. Combining NNYFS and NHANES Data.....	25
8. Conclusions	26
9. References	27
10. Glossary.....	29

Text Tables

- A. Children’s Physical Activity Feasibility Study, 2011
- B. Examinations by sample domain, NNYFS 2012
- C. Summary of forms used in the consent process, NNYFS 2012
- D. Sample person questionnaire, NNYFS 2012
- E. Family questionnaire, NNYFS 2012
- F. Examination components, NNYFS 2012
- G. Remuneration amounts, NNYFS 2012
- H. Distribution of the sample by age at screening, NNYFS 2012
- I. Distribution of the sample by race and Hispanic origin, NNYFS 2012
- J. Unavailable values in data, NNYFS 2012
- K. Appropriate uses of the weights, NNYFS 2012

Figure. Diagram of the mobile center (MC)

Abstract

Background

In October 2008, the federal government issued its first-ever Physical Activity Guidelines for Americans to provide science-based guidance on the types and amounts of physical activity that provide substantial health benefits for Americans (1). Guidelines for children and adolescents recommend 60 minutes or more of aerobic, muscle-strengthening, or bone-strengthening physical activity daily (1). While the number of children in the U.S. who meet the recommendations in the Physical Activity Guidelines is unknown, the percentage who are physically active in the U.S. may be declining. There are no recent national data on the fitness levels of children and adolescents.

The NHANES National Youth Fitness Survey (NNYFS) was conducted in 2012 and collected data on physical activity and fitness levels on children and adolescents in the U.S. aged 3 to 15 years.

Objectives

The objective of the NNYFS was to provide national-level estimates of the physical activity and fitness levels of children based on interview and physical examination data. Results from the survey are intended to contribute to the development of policies and programs to improve youth fitness nationally. The data may also be used in the development of national reference standards for measures of fitness and physical activity.

Methods

The NNYFS survey design was based on the design for the National Health and Nutrition Examination Survey (NHANES), which is a multi-stage probability sample of the civilian, non-institutionalized resident population of the U.S. The NNYFS consisted of a household interview and a physical activity and fitness examination in a mobile examination center. A total of 1,640 children and adolescents aged 3–15 years were interviewed and 1,576 were examined in the NNYFS.

Keywords: mobile examination center; physical activity; fitness, children; youth; National Health and Nutrition Examination Survey; National Youth Fitness Survey

1. Introduction

In October 2008, the federal government issued its first-ever Physical Activity Guidelines for Americans to provide science-based guidance on the types and amounts of physical activity that provide substantial health benefits for Americans (1). The Guidelines for children and adolescents recommend 60 minutes or more of physical activity daily. Activities include moderate-intensity or vigorous-intensity aerobic activity (e.g., running, karate, or bicycle riding), muscle-strengthening activity (e.g., tree climbing, swinging, or gymnastics), or bone-strengthening activity (e.g., hopping, skipping, or jumping) (1).

One out of every three children in the U.S. is now overweight or obese (2). This may increase their risk of developing diabetes, heart disease, and cancer over the course of their lives. Regular physical activity in children and adolescents promotes health and fitness and may help to prevent obesity (1).

Estimates of the number of U.S. children who meet the physical activity guidelines are limited. Data from Health Behavior in School-aged Children 2001–2009 quadrennial surveys, nationally representative samples of U.S. children in grades 6 to 10, identified significant increases in the number of days per year with at least 60 minutes of physical activity (3). However, data from the CDC’s Youth Risk Behavior Surveillance System (YRBSS) indicates that the percentage of children in grades 9 to 12 who are physically active in the U.S. is declining (4).

NHANES has administered tests of physical activity and fitness that included children and adolescents. A physical activity monitor was fielded for participants 6 years and older in 2003–2006 and was implemented again in 2011. In 1999–2004, cardiovascular fitness was reported as estimated maximal oxygen uptake (VO₂ max) from a treadmill test for participants aged 12–49 years. A grip strength component was implemented in 2011 for participants aged 6 years and older. However, the inclusion of additional tests of physical activity in NHANES for children as young as 3 years of age would provide further information with which to evaluate changes in the health of children and adolescents over time.

2. Planning and Sample Design

In 2011, NCHS received Affordable Care Act funds from the Department of Health and Human Services (HHS) to plan, implement, and conduct the NNYFS. No national study of the physical fitness of children in the U.S. had been conducted since the mid-1980s. The Secretary of DHHS, had dedicated funds to Obesity Prevention and Fitness, one of four critical priorities for the Department, in line with the 2010 Affordable Care Act: Laying the Foundation for Prevention (5). The Obesity Prevention and Fitness priority advances activities to improve nutrition and increase physical activity to promote healthy lifestyles and reduce obesity related conditions and costs.

The NNYFS was the first national survey of youth physical activity and fitness to be conducted jointly with NHANES. For information on NHANES, visit <http://www.cdc.gov/nchs/nhanes.htm>. The NNYFS sample was designed so that data from components common to both surveys in 2012, such as the body measures, physical activity monitor, muscle strength (grip strength), physical activity questionnaire, and dietary recall, could be analyzed together. The NNYFS itself included additional tests of cardiovascular capacity, performance endurance, core strength, upper and lower body strength, and gross motor skills, as well as questions on health characteristics and drug, alcohol,

and tobacco use. The NHANES-NNYFS project involved identifying which activities could be conducted in both surveys to provide a larger sample size for analysis, developing an innovative sample design that incorporated both surveys, training of interviewers to administer questionnaires for both studies simultaneously, and refurbishing NHANES trailers for a new use.

Time to plan and implement NNYFS data collection during 2011 was about 8 months. Record planning and implementation for DHANES included the refurbishment of three NHANES trailers, preparation of protocols for the physical activity and fitness tests, planning and conducting a feasibility study of the tests, purchasing equipment to outfit the refurbished trailers, developing a physical activity questionnaire, and hiring and training health examiners. Other challenges included incorporating ten NNYFS components into the limited space of a single trailer and a tight survey schedule. Screening, interviewing, and examinations for the NNYFS were accelerated since the mobile examination centers were operating at each survey location for only 2½ to 3 weeks as opposed to 5 to 6 weeks for NHANES.

2.1. Children’s Physical Activity Feasibility Study

Planning for a feasibility study of NNYFS components began in early spring 2011 with input from recognized experts in physical activity and kinesiology from within the Federal government and academia and from a review of the scientific literature. Six tests were selected or developed by DHANES staff that would provide nationally representative data on fitness and physical activity while still being conducted in the limited space available in a single trailer. To provide the most accurate evaluation of the feasibility of these tests in a confined mobile environment, the Children’s Physical Activity Feasibility Study (CPAFS) was conducted by DHANES staff in a NHANES trailer refurbished for use in the study. The CPAFS took place in suburban Maryland in late-summer 2011. One hundred sixty-nine children aged 3–15 years were recruited and participated in the study. Necessary consent was obtained prior to participation. Included in the CPAFS were one test to measure physical activity, five tests of endurance and muscle strength, and measurement of height and weight (Table A).

Table A. Children’s Physical Activity Feasibility Study, 2011

Tests	Target Ages (years)
Physical activity monitor—accelerometer	3–5
Endurance performance—treadmill	6–11
Lower body muscle strength (sitting and prone positions, extension and flexion)	6–15
Modified pull-up (upper body muscle strength)	5–15
Plank exercise (core strength and muscular endurance)	3–15
Gross motor skills (balance and coordination)	3–5

2.2. Sample Design

The NNYFS was conducted concurrently with NHANES in 2012, the second year of the NHANES 2011–2012 survey cycle, with survey participants selected from an independent sample of dwelling units (DUs) within the segments selected for that year of NHANES. The minimum measure of size for the 2012 segments was increased above the rates established for the NHANES 2011–2014 sample to ensure sufficient DUs for both surveys in the selected segments.

NHANES and NNYFS had four stages of sampling. First, the primary sampling units (PSUs) (mostly counties) were selected to meet the analytic goals for NHANES. Second, segments large enough to ensure there were enough DUs for both surveys were selected within PSUs. The third and fourth stages were to select DUs/households specific to the NNYFS and individuals within those households, so that no households had both NHANES and NNYFS participants. The NNYFS design differed from that of the NHANES in that participants were selected based on sex and age only (income and race and Hispanic origin were not selection criteria).

The goal for the NNYFS was to interview and examine approximately 1,500 children and adolescents aged 3–15 years with approximately equal sample sizes for each single-year of age. In addition, six analytic domains (males 3–5, females 3–5, males 6–11, females 6–11, males 12–15, and females 12–15) were defined for the survey. The targeted number of examinations and actual number of achieved interviews and examinations, by the six age-sex analytic domains, are shown in Table B. A total of 2,065 children and adolescents aged 3–15 years were selected to participate in the survey. Of these, 1,640 (79.4%) were interviewed and 1,576 (76.3%) were examined.

Table B. Examinations by sample domain, NNYFS 2012

Age and sex domains	Target number of examinations (%)	Number of interviews (%)	Number of examinations (%)
Males 3–5	173 (11.5)	187 (11.4)	179 (11.3)
Males 6–11	346 (23.1)	377 (23.0)	358 (22.7)
Males 12–15	231 (15.4)	259 (15.8)	250 (15.9)
Females 3–5	173 (11.5)	181 (11.0)	173 (11.0)
Females 6–11	346 (23.1)	385 (23.5)	374 (23.7)
Females 12–15	231 (15.4)	251 (15.3)	242 (15.4)
Total 3–15	1,500 (100)	1,640 (100.0)	1,576 (100.0)

3. Ethical, Privacy, and Confidentiality Considerations

The NNYFS protocol was developed to be in compliance with the HHS Policy for Protection of Human Research Subjects (45 CFR part 46) (<http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.html>) and was approved by the NCHS Research Ethics Review Board. All data collected were protected by three Federal laws: 1) the Privacy Act of 1974 (5 U.S.C. 552a), 2) section 308(d) of the Public Health Service Act (42 U.S.C. 242m), and 3) the Confidential Information Protection and Statistical Efficiency Act (CIPSEA) (PL107-347). The Public Health Services Act stipulates that "...no information may be used for any purpose other than the purpose for which it was supplied unless... [a] person consented to its use for such other purpose, and further that it cannot be released or published in a form that the particular ... person supplying the information or described in it is identifiable unless such ... person has consented ...". These strict prohibitions, forbidding even unintentional unauthorized disclosures, guided the behavior of all NCHS staff and all contractor staff. Anyone breaking these laws could be fined and sent to prison.

3.1. Ethics Review Board

The NCHS Research Ethics Review Board (ERB) protected the rights and welfare of participants in the NNYFS. In accordance with the Federal Regulations (45 CFR 46.111), the NCHS ERB reviewed and approved NNYFS protocols and any changes made to them. This process ensured the ethical treatment of NNYFS participants.

3.2. Informed Consent

The informed consent process for the NNYFS followed procedures established for the NHANES. If the parent/guardian for one or more sample persons identified through the screening process was available, the interviewer continued with the home interview. If the parent/guardian for the selected sample person was not available, the interviewer made an appointment to return to administer the sample person (SP) and family questionnaires. Documented signed consent was obtained from each participant's parent/guardian (required to be 18 years or older) prior to the household interview and the appointment at the NNYFS mobile center (MC). Participants aged 7–15 years additionally provided signed assent to participate in the examination portion of the NNYFS. Each participant was provided a copy of his/her signed parent/guardian consent and a consent brochure, which included information on participation. The consent brochure is available on the NNYFS website at <http://www.cdc.gov/nchs/nyfs/brochures.htm>.

In addition, participants aged 12–15 years answered the questions in the Physical Activity section of the SP questionnaire themselves and signed a consent form for that section. The appointment for the MC examination was made after the home interview was completed. If participants were not available at the time of the household interview, they were able to consent to the physical activity questions at the MC before their examination. Table C provides a summary of the forms used to complete the consent process for the NNYFS.

Table C. Summary of forms used in the consent process, NNYFS 2012

Participant ages	Home interview consent for participants 3–15 years old	Home interview assent for physical activity questions	Parental permission to audiotape household interview	Parental consent/assent permission for examination	Child assent for examination
3–5 years	Signed by parent	N/A	Signed by parent	Signed by parent	N/A
6–11 years	Signed by parent	N/A	Signed by parent	Signed by parent	Signed by participant (7–11 years)
12–15 years	Signed by parent	Signed by participant	Signed by parent	Signed by parent	Signed by participant

4. Field Operations

The NNYFS was operationally designed to achieve high response rates, a minimum of 1,500 children, and high quality data. Field operations included advance arrangement activities, staffing, training, and interviewing.

4.1. Advance Arrangements

All DUs selected for the NNYFS were sent an advance letter approximately 3 weeks before interviewing started that introduced the NNYFS, provided contact information for NCHS, and explained that an interviewer would be making a home visit. All other advance arrangement activities for the NNYFS, such as finding locations for the trailers and notifying local community leaders, were performed in conjunction with the NHANES. Details of advance arrangement activities are available in the National Health and Nutrition Examination Survey: Plan and Operations, 1999–2010 (6).

4.2. Staffing

The field staff included the field office and interviewers. The field office consisted of a study manager, field manager, office manager, and 2 assistant office managers at each survey location. The field office supported both NHANES and the NNYFS with regard to household interviewing and examination data collection. The interviewers also supported both the NNYFS and NHANES, but were proficient at making contact with residents of sampled households. Interviewers administered the screener questionnaire, obtained all consents, and administered all household interview questions.

4.3. Household Interview

4.3.1. Screener

The NNYFS screener module consisted of a set of questions to determine if any child in the household was eligible to participate in the survey. The interviewer verified the household address and asked questions regarding the number of people living in the household, the names of household members, and their ages and sexes. This was a very brief interview and was conducted at the door. If an eligible child was identified, the interviewer proceeded with the household interview. Circumstances preventing an interviewer from completing a screener questionnaire included:

- A vacant unit or residence.
- An address not qualifying as a DU.
- A nonexistent sampled DU.
- A household resident refusing to participate.

4.3.2. Sample Person and Family Questionnaires

The household interview included administration of the Sample Person (SP) questionnaire and a short family questionnaire. The SP questionnaire collected information on the participant's demographic, socioeconomic, dietary, and health-related history (Table D). It was administered to all eligible participants or their proxies. Participants aged 12–15 years were required to answer the questions in the Physical Activity section themselves. If they were not at home at the time of the household interview, they were asked the physical activity questions at the MC.

The family questionnaire (Table E) was completed for every family unit (e.g., a married couple, a couple living as married, and others) sampled within the household. The U.S. Census Bureau's Current Population Survey (CPS) family definitions were used (7). A household with more than one family applied to those where unrelated persons were residing (e.g., roommates, lodgers, guests without permanent housing, and others). The family questionnaire included questions on the country of birth and level of education of the non-sampled head of the household and family income. All NNYFS questionnaires are available on the NNYFS website at <http://www.cdc.gov/nchs/nyf/questionnaires.htm>.

At the conclusion of the household interview, the interviewer scheduled an appointment for the participant to be examined in the NNYFS MC. A reminder letter was mailed to the participant one week before the scheduled examination. The reminder letter included the date and time of the examination appointment, transportation information, directions to the MC, instructions on what to wear and bring, and the remuneration amount. The letter also emphasized the requirement that all children must be accompanied by an individual 18 years or over. Forty-eight hours before an examination appointment, the field office staff called the participant's home to provide a reminder of the upcoming examination. Instructions related to the examination were reviewed with the participant or the parent/guardian. If the participant did not have a phone, the interviewer visited the home to provide an in-person reminder.

Table D. Sample person questionnaire, NNYFS 2012

Questionnaire section	Description
Acculturation (ACQ)	Primary language(s) used at home, mother's and father's countries of origin
Demographics (DMQ)	Level of education, race and Hispanic origin, country of origin
Diabetes (DIQ)	History of diabetes and pre-diabetes; now taking insulin or diabetic pills
Dietary Supplements and Prescription Medication (DSQ)	Use of supplements, nonprescription antacids, and prescription medications
Diet Behavior and Nutrition (DBQ)	School breakfast and lunch program utilization, number of meals eaten away from home, use of ready-to-eat foods, frozen meals and frozen pizzas
Early Childhood (ECQ)	Whether mother smoked while pregnant, weight at birth, history of overweight
Health Insurance (HIQ)	Healthcare coverage and type of insurance
Hospital Utilization and Access to Care (HUQ)	General health status, place goes to most often when sick
Medical Conditions (MCQ)	History of asthma, use of medication for asthma, trouble seeing, menstruation
Physical Activity (PAQ)	Vigorous or moderate intensity activities and sports and frequency and length of time spent in those activities, walking and bicycling for travel, sitting, television viewing, computer and video game use (additional questions were asked of participants 12–15)
Physical Functioning (PFQ)	Physical impairments, use of special equipment, participation in special education or use of early intervention services
Respiratory Health and Disease (RHQ)	Wheezing and limitation of activity due to wheezing or whistling

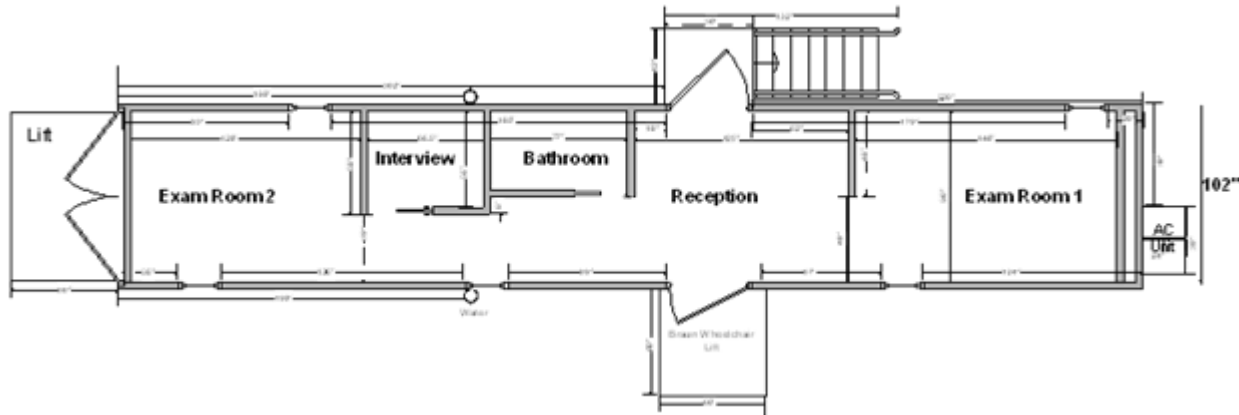
Table E. Family questionnaire, NNYFS 2012

Questionnaire section	Description
Demographic Background/Occupation (DMQ-FAM)	Level of education, race and Hispanic origin, country of origin
Income (INQ)	Family and total household income

5. Mobile Center (MC) Operations

The NNYFS MC consisted of a single trailer that traveled with the four NHANES MEC trailers, but was not physically connected to any of the NHANES trailers at survey sites. All locations for the NHANES trailers were chosen to accommodate the additional stand-alone NNYFS trailer. The NNYFS trailer was designed to accommodate physical activity and fitness examinations and interviews and consisted of two large examination rooms and one interview room (Figure).

Figure. Diagram of the mobile center (MC)



The MC was a non-smoking facility. Each MC was equipped with safety equipment and supplies.

5.1. Staffing

The NNYFS employed one examination team that spent 2½ to 3 weeks at each survey location. The MC staff was selected based on previous experience with children, academic training, knowledge, skills, and abilities. The staff included two nurse practitioners and two examiners with exercise physiology/nutrition or kinesiology degrees. Two of the staff were bilingual to address language needs of Spanish-speaking survey participants. Training for the MC staff was rigorous and included learning the objectives and goals of each examination component, demonstrations of protocols and procedures, live practice of protocols and procedures with the contractor's home office staff and paid volunteers, learning the quality control and quality assurance procedures, maintaining and calibrating equipment, learning MC opening and closing protocols, and maintaining the inventory for supplies.

5.2. Safety Precautions

All children were accompanied to the MC by an individual 18 years or over. The nurse practitioners administered the Nurse Review, which asked the parent/guardian questions regarding physical disabilities, injuries, surgeries, or medications that would exclude their child from participating in a component. The Nurse Review Program Manual can be found at <http://www.cdc.gov/nchs/nyf/manuals.htm>. MC staff were present during all examination components, which were stopped immediately with any participant complaint of discomfort or pain. All components also were stopped immediately if the participant was not able to follow instructions sufficiently.

5.3. Examinations

The NNYFS examination components had either been administered in the NHANES or tested in the CPAFS and included standardized measurements of anthropometry, core strength, upper and lower body muscle strength, cardiovascular fitness, and gross motor development. The NNYFS examination components are listed in Table F.

All participants were asked to dress in comfortable, loose-fitting short-sleeved or sleeveless shirts and shorts. Participants wore running or tennis shoes and socks. Shorts and sneakers were available for children who did not come appropriately dressed for the examination.

The controlled environment of the MC allowed physical measurements to be conducted under identical conditions at each survey site. Eligibility for examination components was determined by the participant's age and exclusions identified during the Nurse Review. The following sections describe the MC examination and interview components. More detailed information on the components is available on the NNYFS website at <http://www.cdc.gov/nchs/nyfs.htm>.

Table F. Examination components, NNYFS 2012

Components	Target Age (years)	Source	Report of Findings
Body measures	3–15	NHANES	Yes (Height, weight, BMI)
Core muscle strength (plank)	3–15	CPAFS	No
Gross motor skills	3–5	CPAFS	No
Lower body muscle strength (extension at the knee in sitting position)	6–15	CPAFS	No
Upper body muscle strength (grip strength)	6–15	NHANES	Yes (7–15 y only)
Upper body muscle strength (modified pull-up)	5–15	CPAFS	Yes
Physical activity monitor (accelerometer)	3–15	NHANES/CPAFS	No
Aerobic Fitness (maximal and submaximal exercise test)	6–15	NHANES/CPAFS	Yes (12–15 y only)
Computer-assisted self-interview (CASI)	12–15	NHANES	No
Dietary recall interview	3–15	NHANES	No
Physical activity questionnaire (if not administered in the household interview)	12–15	NHANES	No

5.3.1. Body Measures

All participants aged 3–15 years were eligible for the body measures component. Measurements included height and weight; lengths of the entire arm and upper arm; mid-arm, mid-calf, and waist circumferences; and subscapular, triceps, and calf skinfold thicknesses. The NNYFS body measures component included the same standardized methods that have been employed in NHANES since the first survey was conducted in 1960–1962. Height, weight, and body mass index, calculated as weight in kilograms/height in centimeters squared, were included in the Report of Findings. For more information see the Body Measures procedures manual at http://www.cdc.gov/nchs/data/nnys/BODY_Measures.pdf.

5.3.2. Core Muscle Strength (Plank)

Participants aged 3–15 years were eligible for the plank or core muscle strength component. The plank exercise assessed muscular endurance and core strength around the trunk and pelvis. The component used the front plank position in which the participant lays face down on a mat, resting on the forearms with hands clenched or palms flat on the floor. The participant then pushed off the floor, raising up onto toes, and maintained the position as long as possible while keeping the back straight and without the stomach dropping or hips rising up. No results were reported to the participants. These data will provide the first nationally representative data on core strength for children and adolescents. For more information see the Plank procedures manual at <http://www.cdc.gov/nchs/data/nnys/Plank.pdf>.

5.3.3. Gross Motor Skills

Participants aged 3–5 years were eligible for the gross motor skills component. Gross motor skills involve the large muscles of the body that enable major body movement such as walking, maintaining balance, coordination, jumping, and reaching. Children with better-developed motor skills may find it easier to be active and engage in more physical activity than those with less-developed motor skills. The Test of Gross Motor Development (TGMD-2) (8) was used for the component. The TGMD-2 has been used by researchers in the U.S. and internationally and is a norm-referenced measure of common gross motor skills that develop early in life. The TGMD-2 is made up of two subtests with six skills for each subtest: locomotor (running, galloping, hopping, leaping, horizontal jumping, and sliding), and object control (striking a stationary ball, stationary dribbling, kicking, catching, overhand throwing, and underhanded rolling). The developer of the TGMD-2 provided consultation on the component. No results were reported to the participant. The gross motor skills component will provide the first nationally representative data on locomotion and object control skills for young children. For more information see the Gross Motor Skills procedures manual at <http://www.cdc.gov/nchs/data/nnys/TGMD.pdf>.

5.3.4. Lower Body Muscle Strength

Participants aged 6–15 years were eligible for the lower body muscle strength (LBMS) component. A hand-held dynamometer (HHD) was used to assess lower body muscle strength (quadriceps strength) through measurement of maximum isometric knee extension force in the sitting position. The LBMS chair was specifically developed and built for isometric testing. The participant's hips,

thigh, and upper body were secured on the test chair with straps. Isometric resistance was supplied using a belt passing through a strap on the HHD and around the chair. Participants were asked to push their legs as hard as possible against the HHD in three tests of each leg, alternating legs. A professor of kinesiology, physiology and neurobiology provided consultation for the component. No results were reported to the participant. The LBMS component will provide the first nationally representative lower body muscle strength data for children and adolescents. For more information see the Lower Body Muscle Strength procedures manual at http://www.cdc.gov/nchs/data/nnys/Lower_Body_Muscle_Strength.pdf.

5.3.5. Upper Body Muscle Strength—Grip Strength

Participants aged 6-15 years were eligible for the muscle strength or grip strength component. NHANES implemented the isometric grip strength test in 2011 to provide data for comparison with data on upper body muscle strength from National Health Examination Survey cycles II and III, 1963–1970, which included a grip test for children 6–11 and 12–17 years old, respectively. The NHANES grip strength test was developed in collaboration with the National Cancer Institute (NCI). NNYFS used the same protocol for the grip strength test used in NHANES. The participant was asked to squeeze a dynamometer adjusted for the participant's hand size as hard as possible three times in each hand, alternating hands. A derived variable (in pounds of force) created from the sum of the highest reading from each hand was included in the Report of Findings. The classification of strength included in the Report of Findings for ages 7–14 years was based on reference data from the Canada Fitness Survey Longitudinal Study (9) and for age 15 years from the Canadian Physical Activity, Fitness and Lifestyle Approach (CPAFLA) (10). Results were not reported for participants 6 years of age. For more information see the Grip Strength procedures manual at http://www.cdc.gov/nchs/data/nnys/Handgrip_Muscle_Strength.pdf.

5.3.6. Upper Body Muscle Strength—Modified Pull-up

Participants aged 5–15 years were eligible for the modified pull-up component. The modified pull-up measures upper body muscle (back, shoulder, forearm, and arm) strength. The component used a specially constructed horizontal bar positioned at a height that allowed the participant to clasp the bar with an overhand grasp when lying flat on the back. The participant raised his/her body by flexing the arm until the chest touched a strap hanging down from the horizontal bar, then lowered back to the starting position while keeping the body straight with the hips up and only the heels touching. The procedure was repeated as many times as possible by the participant. The number of correctly completed pull-ups was compared to the number of age- and sex-specific Healthy Fitness Zone pull-ups in Fitnessgram® and provided to the participant in his/her Report of Findings. FitnessGram® is a battery of health-related fitness items scored using criterion-referenced standards (11). The modified pull-up component will provide the first nationally representative data against which schools can compare results from their districts. For more information see the Modified Pull-Up procedures manual at http://www.cdc.gov/nchs/data/nnys/Modified_Pullup.pdf.

5.3.7. Physical Activity Monitor—Accelerometer

All participants aged 3–15 years were eligible for the physical activity monitor (PAM) component, including children who were wheelchair bound. Monitors were placed on the wrist of the participant's non-dominant arm at the MC. Participants were asked to wear the monitors 24 hours

per day for seven full days, with measurements beginning the day after their examinations. The monitors were water resistant and could be worn while swimming, showering, or bathing. While a PAM component for measuring physical activity was fielded in NHANES in 2011 for ages 6 years and older, to be consistent with the NNYFS component eligibility was changed in 2011 to include ages 3–5 years. The same accelerometer used in the NHANES was used in the NNYFS. After the monitors were returned in the postage-paid padded envelopes provided, remuneration checks for \$40 were mailed to the survey participants. No results were reported to the participant from the PAM component. Currently, there are no standards or norms for reporting. The NHANES 2012 and NNYFS will provide the first nationally representative data on measured physical activity levels for children aged 3–5 years. For more information see the Physical Activity Monitor procedures manual at http://www.cdc.gov/nchs/data/nyfs/Physical_Activity_Monitor.pdf.

5.3.8. Aerobic Fitness—Maximal and Submaximal Exercise Test

Participants aged 6–15 years were eligible for the treadmill component. Two treadmill protocols were used in the NNYFS. The protocol developed for ages 6–11 years measured endurance performance based on duration on the treadmill with increasing speed and incline. The protocol had been approved by the NCHS ERB and tested successfully in the CPAFS. The treadmill protocol for ages 12–15 years was a submaximal exercise test that had been conducted previously in NHANES 1999–2006 to measure aerobic capacity: http://www.cdc.gov/nchs/nhanes/nhanes2003-2004/CVX_C.htm. A treadmill designed specifically for exercise testing was used for both protocols; four leads with electrodes were attached to the participant's chest to measure heart rate.

Participants were given time to practice before test initiation in order to familiarize themselves with treadmill walking and a cool-down period at the end of the test. Two examiners were present during the treadmill test, one monitoring the heart rate data and treadmill and the other encouraging and monitoring the participant. As the test proceeded, the examiner continually assessed how the participant was doing by direct observation and reviewing heart rate readings. The treadmill component included two levels of priority criteria that warranted an emergency stop of the protocol. Stopping criteria included distress observed by the health examiner or reported by the participant, a request by the participant to stop, and equipment failure. A pediatric cardiologist provided consultation for the treadmill component. Results were not reported to participants aged 6–11 years since there are no established standards against which to evaluate endurance performance in children. The Report of Findings for participants aged 12–15 years provided incline, speed, duration, and general fitness classification relative to the same sex and age group based on estimated maximum work capacity (VO₂ max) in FitnessGram® (11). For more information see the Treadmill procedures manual at <http://www.cdc.gov/nchs/data/nyfs/Treadmill.pdf>.

5.4. MC Interviews

5.4.1. Physical Activity Questionnaire

The physical activity questionnaire was administered to participants aged 12–15 years in the MC only if the participant was unavailable to answer questions during the household interview. See Table D for more information on the physical activity questionnaire.

5.4.2. Dietary Recall

All participants aged 3–15 years were eligible for the dietary recall interview. The dietary interview for the NNYFS was the same interviewer-administered computer-assisted 24-hour dietary recall administered in the NHANES. The NNYFS included only the in-person interview in the MEC; unlike NHANES, the second day telephone interview was not conducted. The objective of the dietary interview component was to obtain detailed dietary intake information from NNYFS participants on the types and amounts of foods and beverages (including all types of water) consumed during the 24-hour period prior to the interview (midnight to midnight). The dietary interview also included questions on dietary supplements (e.g., vitamins, minerals, herbals, and non-prescription antacids) consumed during the 24-hour period. The dietary interview component, called What We Eat in America (WWEIA), is conducted as a partnership between the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (DHHS). The questions were included in the NNYFS to be used as covariates in the analysis of the physical activity and fitness data.

5.4.3. Computer-Assisted Self-Interview (CASI)

A short computer-assisted self-interview (CASI) questionnaire was administered by participants aged 12–15 years themselves in the interview room on a touch-screen monitor. The questionnaire did not have an audio component. A small number of questions from the NHANES Tobacco Use (SMQ), Alcohol Use (ALQ), and Drug Use (DUQ) questionnaire sections were included in the self-interview. There were no proxy respondents for the CASI and MEC staff were not present. The questions were included in the NNYFS to be used as covariates in the analysis of the physical activity and fitness data.

6. Report of Findings and Remuneration

All NNYFS Reports of Findings were provided in the MC at the end of the examination appointment; none were mailed. Reports of Findings were provided for components for which standards or norms were available and against which results could be measured. Several of the NNYFS physical activity and fitness components had not been conducted on a national level previously and therefore standards were not available. Reports of Findings were given to participants 12 years of age and older and the parents/guardians of younger children. If the participant was accompanied by an adult other than the parent or guardian, the child received the Report of Findings in a folder labeled “For the attention of (the child’s parent or guardian).”

Average participant burden for the NNYFS was estimated to be 2 hours total: 30 minutes for the household interview and 90 minutes for the examination at the trailer. However, since the actual time burden depended on the participant’s age, the remuneration amount also varied by participant age. For example, the examination time was least for participants aged 3–5 years and greatest for those aged 12–15 years. Therefore, participants aged 12–15 received higher remuneration. Refer to Table G for remuneration amounts. The remuneration was provided at the end of the participant’s examination appointment. The parent/guardian of each participant was also given a monetary incentive, a transportation allowance (not to exceed \$70.00 for driving the participant to the

examination appointment, and childcare expenses (up to \$5.25 per hour for up to 6 hours), if necessary.

Table G. Remuneration amounts, NNYFS 2012

Circumstance	Payment
Participation by children 12–15 years	\$60-75
Participation by children under 12 years	\$40-55
Return of the physical activity monitor	\$40
Parent incentive	\$20

7. Data Release and Analytic Guidelines

At the time of the publication of this document, most of the NNYFS data are publically available and may be downloaded freely at the NNYFS data page. Data files are released as SAS Transport files in .xpt format but may also be used with any package that supports this file format, such as SUDAAN, SPSS, and STATA. Please note that NNYFS is a complex probability sample and proper analysis of the data requires statistical software that specifically incorporates sample design complications such as weighting and clustering.

Prior to beginning any analysis read all relevant documentation to understand how data were collected and released, sample sizes, coding of missing values, skip patterns for questionnaire sections, and other relevant information. Next to each data file name on the NNYFS data page there is a “Doc File” link. This link allows you to view the documentation, including the codebook with the frequency distribution for each item in a particular data file.

The recommended approach for the analysis of NNYFS data is design-based analysis. Design-based analytic procedures explicitly take into account features of the survey design, such as differential selection probabilities and geographic clustering. Important resources for all NHANES analyses, including NNYFS, are the National Health and Nutrition Examination Survey (NHANES): Analytic Guidelines, 1999–2010 (12) and the NHANES Tutorial (13), which is a web-based product designed to assist NHANES users in understanding and analyzing the data. The most important consideration in analyzing NNYFS data is the survey design. Survey sample weights should be used and the complex survey design must be taken into account for variance estimation.

7.1. Key Demographic Variables of Interest

Two age variables are released with the public data files: RIDAGEYR, Age at screening – this variable records the best age in years of the sample child at time of the household screening, and; RIDEXAGY, Age at the examination – this variable records the best age in years at date of examination. Age at screening was used to determine eligibility for an examination component.

Each respondent’s actual or imputed date of birth was used to calculate RIDAGEYR. The procedure that NCHS used to impute age at screening, when the date of birth was missing or refused but the respondent’s age in years was provided, was:

- If month of birth was missing or not given, it is imputed as 7.
- If day of birth was missing or not given, it is imputed as 1.
- If the year of birth was missing or not given, it is imputed as the year of the screening interview minus the age in years provided by the respondent during the screening interview.

Read the Demographic File Documentation on the NHANES website for further details on these age variables.

7.1.1. Defining age group categories

Age groups used in an analysis should be determined by what is most appropriate for the specific analysis, in conjunction with established statistical reliability criteria. Although single year of age is provided in the publicly released data, the sample sizes for such a detailed age classification are too small for meaningful analysis so some form of age grouping is required. When possible, age grouping should be consistent with the survey design groupings: 3–5 years, 6–11 years, and 12–15 years. Table H provides the interview and examination sample sizes for these age groupings. NNYFS questionnaire items and examinations were administered to participants in age ranges that correspond to these sample design age groups.

Table H. Distribution of the sample by age at screening, NNYFS 2012

Age at screening (RIDAGEYR)	Number of interviewed children (RIDSTATR=1 or 2) n (unweighted %)	Number of examined children (RIDSTATR= 2) n (unweighted %)
3–5 years	368 (22.4)	352 (22.3)
6–11 years	762 (46.5)	732 (46.5)
12–15 years	510 (31.1)	492 (31.2)
Total	1,640 (100.0)	1,576 (100.0)

RIDSTATR = Interview and Examination Status of the Sample Person

7.1.2. Race and Hispanic Origin

Race and Hispanic origin was determined based on self-identification (or parent-identification) by respondents with five categories reported in the released data. The race and Hispanic origin variable, RIDRETH1, was derived from responses to the survey questions on race and Hispanic origin. Respondents who self-identified as Mexican American or Other Hispanic (i.e., RIDRETH1=1 or 2, respectively) were categorized as such regardless of their other race identities. Categories for Non-Hispanic persons who self-identified as white or black (i.e., RIDRETH1=3 or 4) include only those who reported a single race. All non-Hispanic persons reporting multiple races are in the “Other Race” category. Table I shows the NNYFS sample distribution by RIDRETH1.

Table I. Distribution of the sample by race and Hispanic origin, NNYFS 2012

Race and Hispanic origin (RIDRETH1)	Number of interviewed children (RIDSTATR=1 or 2) n (unweighted %)	Number of examined children (RIDSTATR= 2) n (unweighted %)
Mexican American, regardless of race	249 (15.2)	242 (15.4)
Other Hispanic, regardless of race	246 (15.0)	238 (15.1)
Non-Hispanic White, single race	639 (39.0)	619 (29.2)
Non-Hispanic Black, single race	371 (22.6)	345 (21.9)
Other Race: Including Multi-Racial	135 (8.2)	132 (8.4)
Total	1,640 (100.0)	1,576 (100.0)

The RIDRETH1 variable is consistent with the race and Hispanic origin variable available for NHANES survey cycles in that the Mexican American and Other Hispanic categories may include persons of multiple races and the Non-Hispanic white and black categories include only those reporting a single race.

Since NNYFS, unlike NHANES, does not contain oversamples of any race or Hispanic origin subgroup, analyses of subgroups (e.g., the aforementioned age categories) within categories of RIDRETH1 may be based on small sample sizes. So analyses by race and Hispanic origin previously performed using NHANES data may not be possible.

7.2. Family Relationship

NNYFS was not designed to produce estimates at the household or family level, only at the person-level. As such, it is not recommended that analysts use the NNYFS public or non-public data to produce household or family level estimates. Only limited information on family and household members' relationship was collected in NNYFS. The publically released data does not contain information on whether one or more survey participants are related or live in the same household. This information as well as information on whether the participants live in the same household is only available through the Research Data Center.

7.3. Geographic and Seasonal Considerations

NNYFS interviewed and examined a nationally representative sample of children located in 15 PSUs across the country. This means that the sampled children in these 15 PSUs represent the approximately 3,000 counties in the United States. **No geographic location, including true PSUs, is released on the publicly available data files in order to protect the identification of NNYFS respondents.**

Due to operational considerations, the geographic scheduling of the NNYFS MC was restricted by consideration of weather. MC operations avoided certain geographic areas during the winter. Thus, the statistical efficiency of the sample is diminished for any variable that may be related to seasonal variation that differs by region of the country. In particular, consumption of certain foods may be subject to the seasonality by geography interaction. Most NNYFS variables are NOT subject to seasonality constraints. The variable RIDEXMON, in the public release Demographic data file, provides the six-month time period in which the examination was performed: November 1 through April 30 and May 1 through October 21.

7.4. Effect of Nonresponse

NNYFS, like most population-based sample surveys, experienced both participant (unit) and component (item) nonresponse. In a statistical sense, nonresponse can be considered ignorable or non-ignorable. If the data are missing at random and the characteristics of the nonrespondents are similar to the characteristics of the respondents, the nonresponse can be considered ignorable. However, nonrespondents may have significantly different characteristics than respondents. In this case, the nonresponse mechanism may be non-ignorable with respect to the data analysis. Ignoring nonresponse in this case leads to biased estimates.

7.4.1. Unit or Sample Child Nonresponse

All eligible children selected to participate in NNYFS who completed the household interview questionnaire were defined as interviewed and all interviewed children who completed one or more examination components in the MC were defined as MC examined. Not all children in the NNYFS sample were interviewed and not all interviewed children were examined. Unit or sample child nonresponse, which is the failure to obtain any information on an individual selected to participate in the NNYFS survey, can occur both at the interview and at the examination phase of the survey. Survey weights specific to the interview and examination help account for any loss due to nonresponse at these stages of the survey.

The interview response rate for NNYFS was 79.4 percent, and the examination response rate (conditional on the interview) was 96.1 percent. This resulted in an overall examination response rate of 76.3 percent (see also http://www.cdc.gov/nchs/nyfys/response_rate_population_totals.htm). However, not all the households selected for NNYFS responded to the screening interview. Applying the screener response rate (98.5%) to the overall examination response rate results in a survey response rate of 75.2 percent.

Nonresponse bias resulting from missing data can be an important source of survey error. Nonresponse bias can be substantial when two conditions hold: 1) the response rate is relatively low; and 2) the difference between the characteristics of respondents and nonrespondents is relatively large. An analysis to assess the relationship between response status and characteristics of the NNYFS sampled children was conducted.

The NNYFS nonresponse bias analysis was conducted in two stages. An initial analysis involved the comparison of demographic and socio-economic characteristics of respondents to those of

nonrespondents. Further analyses were then conducted focusing on nonresponse bias in final outcome statistics. All analyses used design based methods for estimating variances to the extent possible.

The initial analyses showed some indication of potential for bias in the respondent sample, prior to conducting nonresponse adjustments, to the extent that the characteristics analyzed are related to health. However, several of the characteristics found to be significantly related to response status were either used or highly correlated with those used in the weighting adjustments indicating that the bias may have been reduced through the weighting adjustments.

To determine if any of the potential bias identified in the analyses described above remained after the weighting adjustments, estimates of the characteristics of selected persons from the full sample (including the nonrespondents) were compared to estimates for respondents only before and after weighting adjustments for interviewed and examined persons. Very few estimates indicated large relative differences across the stages of weighting for interviewed persons, and none indicated large relative differences for examined persons.

The nonresponse bias analyses performed to date demonstrate potential nonresponse bias before weighting adjustments, but that the weighting adjustments reduced this bias. The methods and results of these and other nonresponse bias analyses will be presented in detail in a forthcoming report.

Adjustments made for survey nonresponse account only for interview or examination nonresponse, but not for component/item nonresponse (e.g., a child declined to participate in the cardiovascular fitness test but completed all other examination components).

7.4.2. Component or Item Nonresponse

There were several components in the NNYFS examination (including physical activity tests, tests of muscle strength and endurance, body measurements, and personal interviews) and each component contained a number of items. Some examinees may not have participated in all components for which they were eligible or may not have fully completed in a particular component, thus resulting in component or item nonresponse. These missing values may distort analysis results.

Analysts must evaluate the extent of missing data in their dataset to determine whether the data are useable without additional re-weighting for item nonresponse. As a general rule, **if 10% or less of data for the main outcome variable for a specific component is missing** for eligible examinees, it is usually acceptable to continue analysis without further evaluation or adjustment. However, if more than 10% of the data for a variable are missing, the analyst may need to further examine respondents and nonrespondents with respect to the main outcome variable, and decide whether imputation of missing values or use of adjusted weights is necessary. It is important to note that even if the overall component is missing less than 10%, a subgroup within the component may exceed 10% and may need to be further examined for statistical bias.

The component nonresponse varies substantially by demographic characteristics of the participants, the type of component, and survey cycle. Analysts are strongly encouraged to examine component nonresponse to determine whether the survey sample weights need to be adjusted. Refer to previous NHANES publications where component/item nonresponse adjustment and re-weighting have been addressed.

7.4.3. Other Key Concepts About Missing Data

NNYFS assigns missing values in the following way:

- a period (.) for **numeric** variables, or
- a blank for **character** variables

However, other types of data may also be important to consider as **unavailable for analysis and part of the unit nonresponse for that variable**. When a sample child refuses to answer a question, a “refused” response is assigned a value of either “7,” “77,” or “777” depending on the number of digits in the variable value range. A “don’t know” response is assigned a value of either “9,” “99,” or “999,” which is also dependent on the number of digits in the variable value range. See Table J below.

Table J. Unavailable values in data, NNYFS 2012

Codes	Description	Action
period (.)	missing numeric value	None
(blank)	missing character value	None
7 or 77 or 777	“refused” response	Code as missing (period or blank)
9 or 99 or 999	“don’t know” response	Code as missing (period or blank)

7.5. Survey Sample Weights

The objective of the NNYFS was to produce data representative of non-institutionalized children in the U.S. The weighting of sample data permits analysts to produce estimates of statistics they would have obtained if the entire sampling frame had been surveyed. A sample weight is assigned to each child. Sample weights can be considered as measures of the number of children represented by the particular sampled child.

Weighting takes into account several features of the survey: the differential probabilities of selection for each child, nonresponse to survey instruments, and differences between the final sample and the total population. The sample weighting was carried out in three steps. The first step involved the computation of weights to compensate for unequal probabilities of selection for various age groups. The second step adjusted for participant nonresponse. Weights were adjusted for nonresponse to the household interview when creating the interview weights and further adjusted for non-response to the MC exam when creating the exam weights. In the third step, the sample weights were post-stratified to match U.S. Census Bureau estimates of all non-institutionalized children in the U.S. These steps were performed for respondents to each stage of the survey: the screener, personal interview, and the examination.

The weighting methodology is similar to that used for NHANES. A more detailed discussion of the weights produced for that survey can be found in the National Health and Nutrition Examination Survey: Estimation, 2007–2010 series report (14).

7.5.1. Determining the Appropriate Sample Weight for Analysis

Three different sample weights are available with the NNYFS data release. Use of the correct sample weight for NNYFS analyses is extremely important and depends on the variables being used. A good rule of thumb is to use “the least common denominator” approach. With this approach, the analyst checks the variables of interest. The variable that was collected on the smallest number of children is the “least common denominator,” and the sample weight that applies to that variable is the appropriate one to use for that particular analysis.

Any eligible child who did not respond to the interview was assigned an interview weight of zero (refer to the section entitled *Unit or sample child nonresponse* for overall response rates). These children were considered ineligible for the examination and also assigned an examination weight of zero. Their records were not included in the publicly released data. Children who did complete the interview and were eligible for the examination but did not complete it, were assigned examination weights of zero and their records are included in the public release. These cases, which have a zero examination weight, should be treated as missing when the exam data are analyzed. Table K lists the appropriate use of each set of weights calculated for NNYFS.

Table K. Appropriate uses of the weights, NNYFS 2012

Weight	Application
Interview weight	Use when analyzing data from the home interview only. Do not use if the analysis also includes variables that were collected on examined children in the MC.
Examination weight	Use when analyzing data from the MC exam. Do not use if the analysis includes variables collected as part of the dietary interview.
Dietary weight	Use when analyzing data from the day one 24-hour dietary recall.

7.6. Variance Estimation

The complex, multistage, probability cluster design of NNYFS will affect variance estimates (sampling error). Typically, individuals within a cluster (e.g., county, school, city, or census block) are more similar to one another than those in other clusters and this homogeneity of individuals within a given cluster is measured by the intra cluster correlation. When working with a complex sample, the ideal situation is to limit the correlation between sample persons within clusters. This is accomplished by sampling fewer people within each cluster but sampling more clusters. However, because of operational limitations similar to those for NHANES (e.g., cost of moving the survey MCs, geographic distances between primary sampling units [PSUs], etc.), NNYFS visited only 15 PSUs.

Variances should be calculated for all survey estimates using the appropriate methods for complex sample surveys to aid in determining statistical reliability. However, it is also important to assess the reliability of the estimated variances themselves.

7.6.1. Variance Estimation Methods

For complex sample surveys, exact mathematical formulas for variance estimation are usually not available. Variance approximation procedures are required to provide reasonable, approximately unbiased, and design-consistent estimates of variance. Variance estimates computed using standard statistical software packages that assume simple random sampling are generally too low (i.e., significance levels are overstated) and biased because they do not account for the differential weighting and the correlation among sample persons within a cluster. Two variance approximation procedures, which account for the complex sample design, are replication methods and Taylor Series Linearization. Currently NCHS recommends the use of the Taylor Series Linearization for variance estimation in NNYFS.

For either linearization or replication, strata and PSU variables must be available on the survey data file. Because of confidentiality issues associated with a two-year data release, true PSUs cannot be released. In order to use the Taylor Series Linearization approach for variance estimation, Masked Variance Units (MVUs) were created and provided in the demographic data file. The NNYFS MVUs are equivalent to Pseudo-PSUs used to estimate variance in past NHANES. The MVUs on the data file are not the “true” design PSUs. They are a collection of secondary sampling units aggregated into groups for the purpose of variance estimation. They produce variance estimates that closely approximate the variances that would have been estimated using the “true” design.

Software, such as SUDAAN, Stata, SPSS, and SAS Survey procedures can all be used to estimate sampling errors by the Taylor Series Linearization method. Software packages that assume a simple random sample should not be used for computing variances for NNYFS. The stratum (SDMVSTRA) and PSU (SDMVPSU) needed for Taylor Series Linearization are included in the demographic data file for the NNYFS data release. See the NHANES tutorial for more detail on software programming code for analysis. Refer to the NHANES Estimation report 2007–2010 (14) for more information on variance estimation in NHANES surveys.

7.6.2. Other Sources of Variability

As with any survey, quality control procedures were established in NNYFS to ensure that sources of error are limited and that the data are of high quality. It is inherent to any measurement process that some sources of variation cannot be controlled and users should be aware of these. Some variables may be subject to within respondent variation. For example, outcomes from a 24 hour dietary recall questionnaire will not be the same if taken on a different day. A child’s measured performance on various physical activity measures may also vary as a result of fatigue or other factors. By reading the data collection protocols, users should be in a better position to interpret NNYFS data relative to the data collection procedures used.

7.7. Statistical Reliability of Estimates

The issues of precision and statistical reliability should be addressed for each specific analysis. This is especially true for NNYFS, given the small number of PSUs in the sample. The statistical reliability of an estimate depends on the sample size on which it is based, the relative standard error and the design effect of the estimate, the reliability of the estimated standard error, and whether the

estimate of interest is a rare event or extreme proportion. Each of these is further described in the National Health and Nutrition Examination Survey Analytic Guidelines, 1999–2010 (12).

If an analysis results in an estimate that cannot be considered reliable, the results should not necessarily be considered insignificant. A reliable estimate may be obtained by collapsing subdomains to increase the analytic sample size.

7.8. Estimation of Population Counts

To understand the public health impact of a condition, it is often helpful to calculate population counts in addition to the prevalence of a health condition. By quantifying the number of people with a particular condition or risk factor, counts directly speak to the burden or magnitude.

There are a few basic steps in calculating a population count for NNYFS (refer to the NHANES Tutorial (13) for further detail):

1. Calculate the unadjusted (crude) prevalence of the health condition or risk factor.
2. Use the relevant population totals from the 2011 American Community Survey (ACS) to determine population estimates in NNYFS. Since NNYFS is a nationally representative survey of **non-institutionalized children in the U.S. population**, population estimates are based on the ACS totals for **this aspect** of the U.S. population. ACS-based population tables for NNYFS by race/ethnicity, gender and age are located at:
http://www.cdc.gov/nchs/nyfys/response_rate_population_totals.htm
3. Multiply the prevalence of the risk factor or health condition of interest by the corresponding ACS-based population total to obtain an estimate of the number of non-institutionalized U.S. children with the risk factor or condition. To calculate age-, sex-, or race/ethnicity- specific population estimates, multiply the prevalence of the health condition in each sub-domain by the ACS population total for the respective sub-domain.
4. Population totals should be reported to the nearest thousand with a 95% confidence interval based on the 95% confidence intervals computed from the prevalence estimate.

Although the non-institutionalized ACS population totals are used to calculate the final sampling weights for the NNYFS, the sum of the final sampling weights for all sample children with the risk factor or health condition of interest cannot be used to arrive at population estimates. The total population estimate for a given risk factor or health condition from the interviewed sample should equal the sum of the final interview weights for individuals with that health condition. However, if there are a significant number of exclusions or missing data for a health condition, summing the weights will not produce an accurate population estimate. Therefore, summing the final sampling weights to arrive at population estimates is not recommended.

Note that the population totals generated in NNYFS can only be representative of the number of children with the health condition in the non-institutionalized U.S. population.

7.9. Combining NNYFS and NHANES Data

The NNYFS sample was designed so that data from components common to both surveys in 2012, such as the body measures, physical activity monitor, muscle strength (grip strength), physical

activity questionnaire, dietary recall, and specific household interview questions could be analyzed together. Therefore, data from NNYFS may be combined with NHANES. Combined weights for NNYFS and NHANES 2012 (1-year weights) are available through the Research Data Center (RDC).

Information on the proposal process and approval are available on the NHANES website. Information on the NCHS Research Data Center, visit <http://www.cdc.gov/rdc/>.

8. Conclusions

NHANES conducted the NNYFS in 2012, collecting the first national data on physical activity measures and physical fitness levels of children and adolescents in the United States since the 1980s. This one-year survey provided data representative of the youth population aged 3–15 years in the U.S. and is currently the only survey to obtain direct physical measures in children and adolescents on a national level. The NNYFS demonstrated that a survey of tests of physical activity and fitness can be conducted successfully in a limited mobile environment. Together with NHANES questionnaire and examination data, NNYFS data will provide a comprehensive picture of the physical health of children in the U.S.

9. References

1. U.S. Department of Health and Human Services website. 2008 Physical Activity Guidelines for Americans. <http://www.health.gov/PAGuidelines/pdf/paguide.pdf>.
2. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in US children and adolescents, 2007-2008. JAMA. 2010;303:242-9.
3. Iannotti RJ, Wang J. Trends in physical activity, sedentary behavior, diet, and BMI among US adolescents, 2001-2009. Pediatrics. 2013 Sep 16. [Epub ahead of print]
4. YRBSS: Youth Risk Behavior Surveillance System. Centers for Disease Control and Prevention. <http://www.cdc.gov/HealthyYouth/yrbs/index.htm>.
5. Affordable Care Act: Laying the Foundation for Prevention. <http://healthyamericans.org/assets/files/The%20Affordable%20Care%20Act%20And%20The%20Prevention%20And%20PH%20Fund%202010%20Allocations.pdf>.
6. Zipf, G, Chiappa M, Porter K, Ostchega Y, Lewis B, Dostal J. The National Health and Nutrition Examination Survey: Plan and Operations, 1999-2010. National Center for Health Statistics. Vital Health Stat 2(156). 2012.
7. U.S. Department of Commerce, United States Bureau of the Census, Current Population Survey (CPS) - Definitions, <http://www.census.gov/cps/about/cpsdef.html>.
8. Test of Gross Motor Development, version 2 (TGMD-2). <http://www.proedinc.com/customer/productview.aspx?id=1776>.
9. Canadian Fitness and Lifestyle Research Institute (1988). Canada Fitness Survey Longitudinal Study: Reference Booklet. Canadian Fitness and Lifestyle Research Institute Ottawa: ON
10. Canadian Society for Exercise Physiology, 2004 (CSEP). The Canadian Physical Activity, Fitness and Lifestyle Approach (CPAFLA) 3rd edition. Ottawa, Canada: Canadian Society for Exercise Physiology, 2004.
11. Cooper Institute. FITNESSGRAM/ACTIVITYGRA Test Administration Manual, Updated 4th Edition, Champaign, IL: Human Kinetics, 2010.
12. Johnson CL, Paulose-Ram R, Ogden CL, et al. National Health and Nutrition Examination Survey: Analytic guidelines, 1999–2010. National Center for Health Statistics. Vital Health Stat 2(161). 2013.
13. The National Health and Nutrition Examination Survey. NHANES Web Tutorial. <http://www.cdc.gov/nchs/tutorials/>.

14. Mirel LB, Mohadjer L, Dohrmann S, Clark J, Burt V, Johnson CL, Curtin LR. The National Health and Nutrition Examination Survey: Estimation Procedures, 2007-2010. National Center for Health Statistics. Vital Health Stat 2(159). 2012.

10. Glossary

Ethics Review Board — In 2003, the NHANES Institutional Review Board (IRB) changed its name to the NCHS Research Ethics Review Board (ERB).

Institutional group quarters — Non-institutional group quarters are quarters that do not provide formally authorized, supervised care or custody. Examples include college/university housing, group homes intended for adults, workers' group living quarters, Job Corps centers, and religious group quarters.

Household — The person or group of persons living in an occupied dwelling unit.

National Center for Health Statistics (NCHS) — NCHS is the Nation's principal health statistics agency. It designs, develops, and maintains a number of systems that produce data related to demographic and health concerns. These include data on registered births and deaths collected through the National Vital Statistics System, the National Health Interview Survey (NHIS), the National Health and Nutrition Examination Survey (NHANES), the National Health Care Surveys, and the National Survey of Family Growth (NSFG), among others. NCHS is one of the Centers for Disease Control and Prevention (CDC), which is part of the U.S. Department of Health and Human Services (DHHS).

Non-institutionalized civilian population — Includes all people living in households, excluding institutionalized group quarters and those persons on active duty with the military. This is the target population for the NNYFS.

Segment — A group of housing units located near one another, all of which were considered for selection into the sample. For NHANES, segments consist of a Census block, or groups of blocks. For NHANES the selection of segments comprises the second stage of sampling. Within each segment, a sample of DUs was selected.